

REMARKS/ARGUMENTS

Applicants thank Examiner Vanoy for the courteous and helpful discussion held with their U.S. and German representatives on September 8, 2003. The results of that discussion are repeated and expanded upon below.

Applicants submit herewith a PTO-1449 together with the DE 1542415 and DE 1904428 documents and kindly request that they be considered. These references are discussed in the specification (paragraph bridging pages 2 and 3, for example) and that corresponding English language equivalents of these references have already been submitted.

The present invention provides a simple and economical process for reliably removing mercaptans as well as other acid gas constituents from gaseous or liquid hydrocarbon streams. The inventors have determined that effective mercaptan removal requires the removal of acid gas components – particularly H₂S and CO₂. The inventors have found that the absorption of the individual components takes place roughly in the order of acid strength, e.g., H₂S, CO₂, COS and mercaptans, and it is not possible to substantially remove the mercaptans without the essentially complete removal of CO₂ and H₂S. See, e.g., the discussion at page 7, lines 13ff of the specification. The present invention, set out in the claims, is not taught in the prior art, and its allowance is kindly solicited.

As was discussed at the interview, the obviousness rejection over US 4,336,233 (US '233) and GB 2191419 (GB '419) is kindly traversed. The present invention is not made obvious by the cited references even in combination. The obviousness rejection is unsustainable, and it should be withdrawn.

As recognized by the Office, US '233 does not teach removing mercaptans from the fluid. The Office attempts to remedy this deficiency with the addition of GB '419. This reliance on GB '419 is misplaced, however. Even if the mercaptans described in GB '419

were inherently present in the synthesis gas or natural gas disclosed in US '233, it is not sufficient to make the present invention obvious.

The US '233 reference is discussed in the present specification. See page 3, for example. US '233 teaches removing H₂S and CO₂ from natural gas and synthesis gas using a combination of piperazine and methyldiethanolamine, but it is completely silent on either the presence or removal of mercaptans. In contrast, GB '419 teaches the *selective* removal of H₂S and, for example, mercaptans, from natural or synthesis gases *but leaving CO₂* using, for example, methyldiethanolamine. GB '419 selectively removes mercaptans, but US '233 does not mention mercaptans at all.

Thus, not only do the references differ in their treatment of mercaptans, they differ in their treatment of CO₂: US '233 removes CO₂, and GB '419 does not remove CO₂. There is no indication in either reference that H₂S, CO₂ *and* at least one mercaptan could be removed. Rather than teaching the present invention, the asserted combination of references results only in confusion.

GB '419 requires excessive cooling either by a refrigerated pre-saturator (example 1 therein) or two intercoolers (comparative example 3 therein). In addition, GB '419 requires that any activator be absent. Activators accelerate the absorption of CO₂ (and also of H₂S). Typically, activators are primary or secondary amines without steric hindrance. Piperazine (or other N-heterocyclic compounds) is a very potent activator. See, US '233, column 1, lines 63-68. The GB '419 process makes use of the fact that whereas CO₂ is a stronger acid than mercaptan, its absorption proceeds slowly in the absence of activators and at low temperatures. Thus, a review of GB '419 leads to the conclusion that the presence of piperazine (or other N-heterocyclic compounds) is detrimental to mercaptan removal. In contrast to the cited references, the present inventors, quite surprisingly, have found that

mercaptan removal is possible even when the scrubbing liquor contains an activator, if the scrubbing liquor is used in an amount to essentially completely remove CO₂ and H₂S.

There is no basis in either reference to conclude that one could remove mercaptans from a fluid stream using the scrubbing liquor as claimed, which requires a C₂₋₁₂ tertiary aliphatic alkanolamine and from 0.5 to 15% by weight of the claimed activator, wherein the amount of scrubbing liquor being supplied to the absorption or extraction zone is sufficient to remove at least CO₂ and H₂S essentially completely from the fluid stream.

For all the reasons given above and in view of the claim amendments, the invention is not obvious over the cited references; the rejection is unsustainable; and the rejection should be withdrawn.

The claim objections and rejections under 35 U.S.C. § 112, second paragraph, have been obviated by amendment. Applicants thank the Examiner for pointing out the typographical errors in their claims, which have been corrected; and Applicants have also removed the objectionable, 'preferably' and 'especially' language. Withdrawal of these objections and rejections is kindly requested.

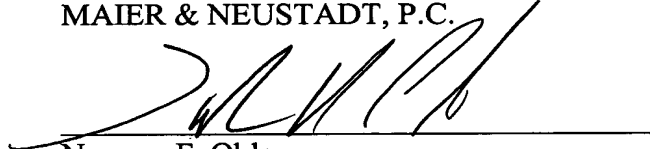
Finally, Applicants thank the Examiner for acknowledging their claim to foreign priority and for indicating that the priority documents have been received.

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This application is now in condition for allowance, and an early indication of same is kindly requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

A handwritten signature in black ink, appearing to read 'N. F. Oblon', is written over a horizontal line.

Norman F. Oblon
Attorney of Record
Registration No. 24,618



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NFO/JKP:sjh

John K. Pike, Ph.D.
Registration No. 41,253